CLAIMS:

1. A device (50) for label-free detection of an analyte (56) in a sample liquid (55), the device (50) comprising:

- at least two conductive surfaces (51a, 51b), at least one of the conductive surfaces (51a, 51b) comprising immobilized target-specific affinity probes (52), and
- means for providing an electrical field with a frequency between 10^{-2} and 10^{6} Hz between the two conductive surfaces (51a, 51b).

2. A device (50) according to claim 1, furthermore comprising a measuring means for measuring amplitude and phase of a first alternating current flowing between a first conductive surface with immobilized target-specific affinity probes and a second conductive surface.

3. A device (50) according to claim 2, furthermore comprising a comparator for comparing amplitude and phase of the first alternating current with amplitude and phase of a reference signal.

4. A device (50) according to any of the previous claims, comprising a first (51a) and a second conductive surface (51b), said first conductive surface (51a) comprising immobilized target-specific affinity probes (52) at at least one side.

5. A device (50) according to any of the previous claims, wherein said first (51a) and said second conductive surface (51b) are positioned substantially parallel to each other, the or a side immobilized with target-specific probes (52) facing said second conductive surface (51b).

6. A device (50) according to claim 4 or 5, wherein at least part of conductive surface (51a) interdigitates with at least part of the conductive surface (51b).

7. A device (50) according to any of the previous claims, wherein said analyte (56) is selected from the group consisting of a peptide, protein, antibody or a fragment thereof, enzyme, polynucleotide, oligonucleotide, carbohydrate, lipid, metabolite, cofactor, hormone, cytokine, cell, microorganism, virus, drug, pesticide, herbicide, fungicide, toxin, vitamin or any other small molecule or a combination of the aforementioned, for example a peptide comprising one or more carbohydrate groups or an enzyme with a bound cofactor.

8. A device (50) according to any of the previous claims, wherein the sample liquid (55) is selected from a group consisting of an analytical solution, a bodily fluid such as blood, plasma, serum, urine, saliva, lung fluid or cerebrospinal fluid, a cell extract, waste water, any fluid in industrial processing, milk, drinking water, surface water or any other food product or solution thereof.

9. A device (50) according to any of the previous claims, wherein the target-specific affinity probe (52) is selected from a group consisting of a peptide, protein, antibody or a fragment thereof, enzyme, polynucleotide, oligonucleotide, aptamer, carbohydrate, oligosaccharide, lipid, metabolite, cofactor, hormone, cytokine, cell, microorganism, virus, drug, pesticide, herbicide, fungicide, toxin, vitamin or any other small molecule or a combination of the aforementioned, for example a peptide comprising one or more carbohydrate groups, an enzyme with a bound cofactor or a multimeric protein.

10. A method for label-free detection of an analyte (56) in a sample liquid (55), the method comprising:

- exposing at least one conductive surface (51a, 51b) with at least one target-specific affinity probe (52) immobilized thereon to a sample liquid (55) to allow association between said analyte (56) in said sample liquid (55) and at least one target-specific affinity probe (52),
- assaying said at least one conductive surface (51a,51b) for the presence of the associated analyte (56), said assaying comprising:
- applying an alternating electrical field between a first of at least one conductive surface (51a) and a second conductive surface (51b) thus generating a first alternating current flowing between said first (51a) and said second conductive surface (51b), the applied electrical field having a frequency between 10^{-2} and 10^{6} Hz,
- measuring an electrical property of said first alternating current,

- comparing, sequentially or simultaneously during any of the preceding steps the measured electrical property of said first alternating current with an electrical property of a reference signal, thus generating a comparison result,
- determining from the comparison result whether analyte (56) has associated with at least one of the target-specific affinity probes (52).

11. A method according to claim 10, wherein the comparing step includes comparing

amplitude and phase of said first alternating current with amplitude and phase of the reference signal.

12. A method according to claim 10 or 11, wherein the electrical field has a frequency between 10^{-2} and 10^{2} Hz.

13. A method according to any of claims 10 to 12, wherein said second conductive surface (51b) comprises the same target-specific affinity probes (52) as the first conductive surface (51a).

14. A method according to any of claims 10 to 13, wherein said reference signal is a calibration signal independently obtained using a conductive surface similar to said at least one conductive surface (51a, 51b) without incubation of an analyte (56).

15. A method according to any of claims 10 to 14, the method furthermore comprising assaying said at least one conductive surface (51a, 51b) at which at least one target-specific affinity probe (52) is immobilized before exposing to the liquid sample (55), resulting in second alternating current.

16. A method according to claim 15, wherein said reference signal is said second alternating current.

17. A method according to any of claims 10 to 16, furthermore comprising removing the sample liquid (55).

18. A method according to any of claims 10 to 17, furthermore comprising rinsing the conductive surface (51a, 51b) with a washing solution to remove material that is non-specifically bound to an immobilized target-specific affinity probe (52).

19. A method according to any of claims 10 to 18, furthermore comprising rinsing the conductive surface (51a, 51b) to replace the sample liquid (55) or the washing solution with a measurement solution.

20. A method according to any of claims 10 to 19, wherein applying an electrical field between the first conductive surface (51a) with at least one immobilized target-specific affinity probe (52) and the second conductive surface (51a, 51b) and measuring amplitude and phase of a first alternating current are repeated while varying the frequency of the alternating electrical field in order to obtain a dielectric spectrum.

21. A method according to claim 20, furthermore comprising varying temperature and/or composition of the washing or measurement solution.

22. A method according to any of claims 10 to 21, wherein the reference signal is a set of measurements or frequency spectra.